MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 3, 2018/2019

BMS1024 – MANAGERIAL STATISTICS

(All sections / Groups)

30 MAY 2019
2.30 p.m. - 4.30 p.m.
(2 Hours)

INSTRUCTIONS TO STUDENTS

1. This question paper consists of **TEN (10)** printed pages inclusive of the cover page, formulae sheet and statistical tables.
2. This question paper consists of **FOUR** structured questions. Attempt **ALL** questions.
3. Students are allowed to use non-programmable scientific calculators with no restrictions. Statistical tables are attached at the end of the question paper.
4. Please use **pen** to write the answers.
5. Please print all your answers in the **Answer Booklet** provided.

Question 1 [Total = 25 Marks]

a) The monthly rents paid by 12 students who live off campus are recorded below.
730, 740, 1030, 660, 850, 930, 500, 720, 730, 1000, 950, 750

(i) Find the median for the monthly rents paid. Interpret your answer. [5 marks]

(ii) Find the interquartile range. [5 marks]

(iii) Find the coefficient of variation. [5 marks]

b) The following table shows the quantities purchased for three consumer goods in the year 2017 and 2018, and the prices paid for them.

Items	2017		2018	
	Price (RM)	Quantity	Price (RM)	Quantity
A	$27.60	14	$28.15	13
B	13.05	6	13.3	9
C	2.15	40	2.3	43

(i) Compute the unweighted aggregate price index for 2018. Interpret the values. [4 marks]

(ii) Compute the value index and interpret the values. [6 marks]

Question 2 [Total = 25 Marks]

a) On the Federal Highway, minor traffic accidents occur at a mean rate of 5.1 per day.

(i) Find the probability that 5 to 7 minor traffic accidents occur on Wednesday. [5 marks]

(ii) Find the probability that at least one minor traffic accident occur during 8am – 9am. [4 marks]

(iii) What is the expected number of minor traffic accidents that occur per week on the Federal Highway? [2 marks]

Continued.....

b) The fracture strength of a certain type of manufactured glass is normally distributed with a mean of 579 MPa with a standard deviation of 14 MPa.
   (i) Find the probability that a selected glass will break at less than 550 MPa. [3 marks]
   (ii) Find the probability that a selected glass will break between 580 MPa and 595 MPa. [6 marks]
   (iii) Find the strength of glass which 85% of these glasses are more than it. [5 marks]

Question 3 [Total = 25 Marks]

A generator is supposed to give an output voltage of exactly 220V. It is measured once an hour, and at the end of the day a technician decides whether adjustment is needed. The following readings are recorded:

213, 223, 225, 232, 233, 237, 238, 232

a) Construct the 99% confidence level for the true population mean output voltage. [12 marks]

b) Test at 1% level of significance that more than 50% of the output voltages are above 220V. [13 marks]

Question 4 [Total = 25 Marks]

Many concerts were held in Genting Highlands and a survey was conducted among the customers who attended these concerts. A random sample of 20 customers was asked about their age and how many concerts they have attended since year 2016. The following data were collected:

Age	62	57	40	49	67	54	43	65	54	41
Number of Concerts	6	5	4	3	5	5	2	6	3	1

Age	44	48	55	60	59	63	69	40	38	52
Number of Concerts	3	2	4	5	4	5	4	2	1	3

Continued...

a) Determine the least squares regression line. [6 marks]
b) Determine the correlation between age and the number of concerts attended. Interpret your answer. [4 marks]
c) Determine the coefficient of determination. [2 marks]
d) Estimate the number of concerts attended by a 35 year old person since year 2016. Is this estimation reliable? Explain. [5 marks]
e) Test at 1% significance level whether the age of customers have significant impact on the number of concerts attended, given that the standard error for slope coefficient to be 0.0221. [8 marks]

End of Page

FORMULAE

A. DESCRIPTIVE STATISTICS

Mean = $\frac{\sum X}{n}$; Standard Deviation (s) = $\sqrt{\frac{\sum X^2}{n-1} - \frac{(\sum X)^2}{n(n-1)}}$

Coefficient of Variation (CV) = $\frac{s}{\bar{x}} \times 100$

Pearson's Coefficient of Skewness (S_k) = $\frac{3(\overline{X} - \text{Median})}{s}$

B. PROBABILITY

P (A or B) = P (A) + P (B) - P (A and B)

P (A and B) = P (A) P (B) if A and B are independent

P (A | B) = P (A and B) / P (B)

Binomial Probability Distribution

If X follows a Binomial Distribution B(n, p) where $P(X = x) = {}^nC_x p^x q^{n-x}$

then the mean = E(X) = np and variance = VAR(X) = npq

Poisson Probability Distribution

If X follows a Poisson Distribution P (λ) where $P(X = x) = \frac{e^{-\lambda}\lambda^x}{x!}$

then the mean = E(X) = λ and variance = VAR(X) = λ

Normal Distribution

If X follows a Normal distribution N(μ , σ) where E(X) = μ and VAR(X) = σ^2

then $z = \frac{X - \mu}{\sigma}$

C. EXPECTATION AND VARIANCE OPERATORS

$E(X) = \sum[X \bullet P(X)]$

$VAR(X) = E(X^2) - [E(X)]^2$

If $E(X) = \mu$ then $E(kX) = k\mu$, $E(X_1 + X_2) = E(X_1) + E(X_2)$

If $VAR(X) = \sigma^2$ then $VAR(kX) = k^2\sigma^2$,

$VAR(aX_1 + bX_2) = a^2VAR(X_1) + b^2VAR(X_2) + 2ab\,COV(X_1, X_2)$

where $COV(X_1, X_2) = E(X_1X_2) - [E(X_1)\,E(X_2)]$

D. CONFIDENCE INTERVAL ESTIMATION & SAMPLE SIZE DETERMINATION

(100 - α) % Confidence Interval for Population Mean (σ Known) = $\mu = \overline{X} \pm Z_{\alpha/2}\sigma_{\bar{x}}$ (100 - α)% Confidence Interval for Population Mean (σ Unknown) = $\mu = \overline{X} \pm t_{\alpha/2,n-1}\sigma_{\bar{x}}$ Where $\sigma_{\bar{x}} = \sigma/\sqrt{n}$ or Where $\sigma_{\bar{x}} = S/\sqrt{n}$ if σ is not known
(100 - α)% Confidence Interval for Population Proportion = $p \pm Z_{\alpha/2}\sigma_p$ Where $\sigma_P = \sqrt{\frac{p(1-p)}{n}}$
Sample Size Determination for Population Mean $= n \geq \frac{(Z_{\alpha/2})^2\sigma^2}{E^2}$ Sample Size Determination for Population Proportion $= n \geq \frac{(Z_{\alpha/2})^2 p(1-p)}{E^2}$ Where E = Limit of Error in Estimation

E. HYPOTHESIS TESTING

One Sample Mean Test	
(Standard Deviation (σ) Known)	**(Standard Deviation (σ) Not Known)**
$z = \frac{\bar{x}-\mu}{\sigma_{\bar{x}}}$ where $\sigma_{\bar{x}} = \sigma/\sqrt{n}$	$t = \frac{\bar{x}-\mu}{\sigma_{\bar{x}}}$ where $\sigma_{\bar{x}} = S/\sqrt{n}$
One Sample Proportion Test	
$z = \frac{p-\pi}{\sigma_p}$ where $\sigma_p = \sqrt{\frac{\pi(1-\pi)}{n}}$	

Two Sample Mean Test

(Standard Deviation (σ) Known)

$$z = \frac{(\overline{x}_1 - \overline{x}_2) - (\mu_1 - \mu_2)}{\sqrt{\sigma_1^2/n_1 + \sigma_2^2/n_2}}$$

(Standard Deviation (σ) Not Known)

$$t = \frac{(\overline{x}_1 - \overline{x}_2) - (\mu_1 - \mu_2)}{\sqrt{S_p^2\left(1/n_1 + 1/n_2\right)}} \quad \text{where} \quad S_p^2 = \frac{(n_1 - 1)S_1^2 + (n_2 - 1)S_2^2}{(n_1 - 1) + (n_2 - 1)}$$

Two Sample Proportion Test

$$z = \frac{(p_1 - p_2) - (\pi_1 - \pi_2)}{\sqrt{\overline{p}(1-\overline{p})\left[\frac{1}{n_1} + \frac{1}{n_2}\right]}} \quad \text{where} \quad \overline{p} = \frac{(n_1 p_1) + (n_2 p_2)}{n_1 + n_2} = \frac{X_1 + X_2}{n_1 + n_2}$$

where X_1 and X_2 are the number of successes from each population

F. REGRESSION ANALYSIS

Simple Linear Regression

$$Y = b_0 + b_1 X_1 \quad \text{where} \quad b_0 = \overline{Y} - \beta_1 \overline{X} \quad \text{and} \quad b_1 = \frac{\Sigma XY - \left[\frac{\Sigma X \Sigma Y}{n}\right]}{\left[\Sigma X^2 - \left((\Sigma X)^2/n\right)\right]}$$

Correlation Coefficient

$$r = \frac{\Sigma XY - \left[\frac{\Sigma X \Sigma Y}{n}\right]}{\sqrt{\left[\Sigma X^2 - \left((\Sigma X)^2/n\right)\right]\left[\Sigma Y^2 - \left((\Sigma Y)^2/n\right)\right]}} = \frac{COV(X,Y)}{S_X S_Y}$$

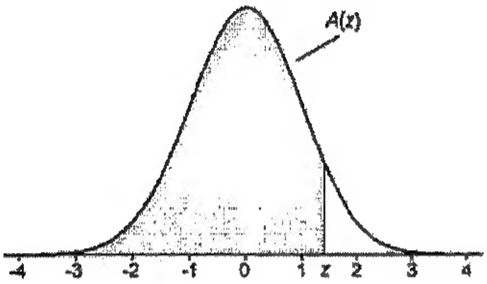
G. INDEX NUMBERS

Simple Price Index $I = \frac{p_t}{p_0} \times 100$	**Simple Aggregate Price Index** $I_U = \frac{\sum p_t}{\sum p_0}(100)$
Laspeyres Price Index $LPI = \frac{\sum p_t q_0}{\sum p_0 q_0} \times 100$	**Paasche Price Index** $PPI = \frac{\sum p_t q_t}{\sum p_0 q_t} \times 100$
Fisher's Ideal Price Index $\sqrt{(\text{Laspeyres Price Index})(\text{Paasche Price Index})}$	**Value Index** $V = \frac{\sum p_t q_t}{\sum p_0 q_0} \times 100$

Table A.1

Cumulative Standardized Normal Distribution

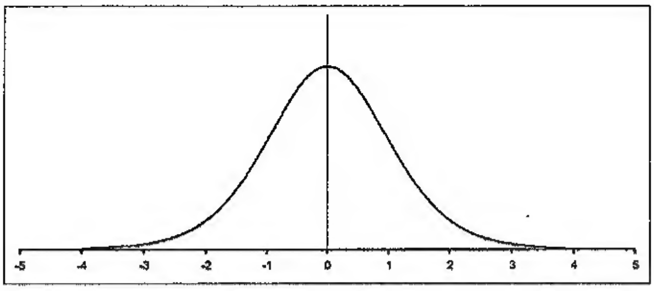
$A(z)$ is the integral of the standardized normal distribution from $-\infty$ to z (in other words, the area under the curve to the left of z). It gives the probability of a normal random variable not being more than z standard deviations above its mean. Values of z of particular importance:



z	$A(z)$	
1.645	0.9500	Lower limit of right 5% tail
1.960	0.9750	Lower limit of right 2.5% tail
2.326	0.9900	Lower limit of right 1% tail
2.576	0.9950	Lower limit of right 0.5% tail
3.090	0.9990	Lower limit of right 0.1% tail
3.291	0.9995	Lower limit of right 0.05% tail

z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	0.5000	0.5040	0.5080	0.5120	0.5160	0.5199	0.5239	0.5279	0.5319	0.5359
0.1	0.5398	0.5438	0.5478	0.5517	0.5557	0.5596	0.5636	0.5675	0.5714	0.5753
0.2	0.5793	0.5832	0.5871	0.5910	0.5948	0.5987	0.6026	0.6064	0.6103	0.6141
0.3	0.6179	0.6217	0.6255	0.6293	0.6331	0.6368	0.6406	0.6443	0.6480	0.6517
0.4	0.6554	0.6591	0.6628	0.6664	0.6700	0.6736	0.6772	0.6808	0.6844	0.6879
0.5	0.6915	0.6950	0.6985	0.7019	0.7054	0.7088	0.7123	0.7157	0.7190	0.7224
0.6	0.7257	0.7291	0.7324	0.7357	0.7389	0.7422	0.7454	0.7486	0.7517	0.7549
0.7	0.7580	0.7611	0.7642	0.7673	0.7704	0.7734	0.7764	0.7794	0.7823	0.7852
0.8	0.7881	0.7910	0.7939	0.7967	0.7995	0.8023	0.8051	0.8078	0.8106	0.8133
0.9	0.8159	0.8186	0.8212	0.8238	0.8264	0.8289	0.8315	0.8340	0.8365	0.8389
1.0	0.8413	0.8438	0.8461	0.8485	0.8508	0.8531	0.8554	0.8577	0.8599	0.8621
1.1	0.8643	0.8665	0.8686	0.8708	0.8729	0.8749	0.8770	0.8790	0.8810	0.8830
1.2	0.8849	0.8869	0.8888	0.8907	0.8925	0.8944	0.8962	0.8980	0.8997	0.9015
1.3	0.9032	0.9049	0.9066	0.9082	0.9099	0.9115	0.9131	0.9147	0.9162	0.9177
1.4	0.9192	0.9207	0.9222	0.9236	0.9251	0.9265	0.9279	0.9292	0.9306	0.9319
1.5	0.9332	0.9345	0.9357	0.9370	0.9382	0.9394	0.9406	0.9418	0.9429	0.9441
1.6	0.9452	0.9463	0.9474	0.9484	0.9495	0.9505	0.9515	0.9525	0.9535	0.9545
1.7	0.9554	0.9564	0.9573	0.9582	0.9591	0.9599	0.9608	0.9616	0.9625	0.9633
1.8	0.9641	0.9649	0.9656	0.9664	0.9671	0.9678	0.9686	0.9693	0.9699	0.9706
1.9	0.9713	0.9719	0.9726	0.9732	0.9738	0.9744	0.9750	0.9756	0.9761	0.9767
2.0	0.9772	0.9778	0.9783	0.9788	0.9793	0.9798	0.9803	0.9808	0.9812	0.9817
2.1	0.9821	0.9826	0.9830	0.9834	0.9838	0.9842	0.9846	0.9850	0.9854	0.9857
2.2	0.9861	0.9864	0.9868	0.9871	0.9875	0.9878	0.9881	0.9884	0.9887	0.9890
2.3	0.9893	0.9896	0.9898	0.9901	0.9904	0.9906	0.9909	0.9911	0.9913	0.9916
2.4	0.9918	0.9920	0.9922	0.9925	0.9927	0.9929	0.9931	0.9932	0.9934	0.9936
2.5	0.9938	0.9940	0.9941	0.9943	0.9945	0.9946	0.9948	0.9949	0.9951	0.9952
2.6	0.9953	0.9955	0.9956	0.9957	0.9959	0.9960	0.9961	0.9962	0.9963	0.9964
2.7	0.9965	0.9966	0.9967	0.9968	0.9969	0.9970	0.9971	0.9972	0.9973	0.9974
2.8	0.9974	0.9975	0.9976	0.9977	0.9977	0.9978	0.9979	0.9979	0.9980	0.9981
2.9	0.9981	0.9982	0.9982	0.9983	0.9984	0.9984	0.9985	0.9985	0.9986	0.9986
3.0	0.9987	0.9987	0.9987	0.9988	0.9988	0.9989	0.9989	0.9989	0.9990	0.9990
3.1	0.9990	0.9991	0.9991	0.9991	0.9992	0.9992	0.9992	0.9992	0.9993	0.9993
3.2	0.9993	0.9993	0.9994	0.9994	0.9994	0.9994	0.9994	0.9995	0.9995	0.9995
3.3	0.9995	0.9995	0.9995	0.9996	0.9996	0.9996	0.9996	0.9996	0.9996	0.9997
3.4	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9998
3.5	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998
3.6	0.9998	0.9998	0.9999							

Table 2: The t-distribution ($t_{\alpha, n-1}$)



α =	0.10	0.05	0.025	0.01	0.005	0.001	0.0005
(n-1) = 1	3.078	6.314	12.706	31.821	63.657	318.309	636.619
2	1.886	2.920	4.303	6.965	9.925	22.327	31.599
3	1.638	2.353	3.182	4.541	5.841	10.215	12.924
4	1.533	2.132	2.776	3.747	4.604	7.173	8.610
5	1.476	2.015	2.571	3.365	4.032	5.893	6.869
6	1.440	1.943	2.447	3.143	3.707	5.208	5.959
7	1.415	1.895	2.365	2.998	3.499	4.785	5.408
8	1.397	1.860	2.306	2.896	3.355	4.501	5.041
9	1.383	1.833	2.262	2.821	3.250	4.297	4.781
10	1.372	1.812	2.228	2.764	3.169	4.144	4.587
11	1.363	1.796	2.201	2.718	3.106	4.025	4.437
12	1.356	1.782	2.179	2.681	3.055	3.930	4.318
13	1.350	1.771	2.160	2.650	3.012	3.852	4.221
14	1.345	1.761	2.145	2.624	2.977	3.787	4.140
15	1.341	1.753	2.131	2.602	2.947	3.733	4.073
16	1.337	1.746	2.120	2.583	2.921	3.686	4.015
17	1.333	1.740	2.110	2.567	2.898	3.646	3.965
18	1.330	1.734	2.101	2.552	2.878	3.610	3.922
19	1.328	1.729	2.093	2.539	2.861	3.579	3.883
20	1.325	1.725	2.086	2.528	2.845	3.552	3.850
21	1.323	1.721	2.080	2.518	2.831	3.527	3.819
22	1.321	1.717	2.074	2.508	2.819	3.505	3.792
23	1.319	1.714	2.069	2.500	2.807	3.485	3.768
24	1.318	1.711	2.064	2.492	2.797	3.467	3.745
25	1.316	1.708	2.060	2.485	2.787	3.450	3.725
26	1.315	1.706	2.056	2.479	2.779	3.435	3.707
27	1.314	1.703	2.052	2.473	2.771	3.421	3.690
28	1.313	1.701	2.048	2.467	2.763	3.408	3.674
29	1.311	1.699	2.045	2.462	2.756	3.396	3.659
30	1.310	1.697	2.042	2.457	2.750	3.385	3.646
40	1.303	1.684	2.021	2.423	2.704	3.307	3.551
60	1.296	1.671	2.000	2.390	2.660	3.232	3.460
120	1.289	1.658	1.980	2.358	2.617	3.160	3.373
∞	1.282	1.645	1.960	2.326	2.576	3.090	3.291